California Department of Pesticide Regulation
Environmental Hazards Assessment Program
830 K Street, Suite 200
Sacramento, California 95814

STANDARD OPERATING PROCEDURE
Equal-Width-Increment Sampling of Surface Waters

KEY WORDS-
Increment; flow; discharge; cross section; transit; vertical

APPROVALS

APPROVED BY: Kean S. Goh DATE: 11/15/99
Kean S. Goh, Management

APPROVED BY: Lisa Ross DATE: 11/9/99
Lisa Ross, EHAP Senior Scientist

APPROVED BY: Carissa Ganapathy DATE: 11/29/99
Carissa Ganapathy, EHAP Quality Assurance Officer

REVISED BY: DeeAn Jones DATE: 11/9/99
DeeAn Jones, Environmental Research Scientist

Environmental Hazards Assessment Program (EHAP) organization and personnel such as management, senior scientist, quality assurance officer, project leader, etc. are defined and discussed in SOP ADMN002.

1.0 INTRODUCTION

1.1 Purpose

This Standard Operation Procedure (SOP) discusses the specific procedure for sampling surface water using the equal-width-increment (EWI) method. A cross-sectional flow-integrated sample obtained by the EWI method will produce a water sample volume that is proportional to the amount of flow at each of several, equally spaced, predetermined verticals in the stream cross section. This document gives instruction on A) determining the number of verticals, B) determining a transit rate, and C) collection of a sample volume.

1.2 Definitions

In the context of this SOP, surface water is defined as all inland waters, excluding groundwater.

2.0 MATERIALS

- **2.1** Wading rod
- **2.2** D-77 Sampling Unit- bronze or aluminum
- **2.3** Bridge Board/Crane and Reel
- **2.4** 5/16" Nozzle/Cap Assembly
- **2.5** 3-liter Teflon® Bottle
- **2.6** Tag-line or Tape Measurer
- **2.7** Composite Sample Container (such as stainless steel milk can)
- **2.8** Stopwatch
- **2.9** Waders (for wading rod method)

3.0 PROCEDURES

Instructions included here are modified from the following document: Edwards, T.K. and D.G. Glysson (1988).

3.1 Determine the Number of Vertical Cross-sections for Sampling

3.1.1 Looking downstream from the sampling site, measure the horizontal distance from the left edge of water to the right edge of water.

3.1.2 Visually inspect the stream from bank to bank, observing the water velocity and depth distribution as well as apparent distribution of sediment in the cross sectional area.

3.1.3 Determine the horizontal width of the increment that represents approximately 10% of the flow at that part of the cross section where the "unit width discharge" is highest (generally the deepest, fastest section). To determine stream discharge, see USGS manual, "Discharge Measurements at Gaging Stations", Book 3, Chapter A8. **This increment must be used for the entire cross section.** Typically, this works out to be from 10 to 20 equal increments for streams 5 or more feet wide. For example, if the stream width determined from the tag-line or tape measure is 160 feet wide and the cross-section where the highest unit width discharge was determined to be 10 feet, then the number of verticals required is 16. The sampling station within each width increment is located at the center of the increment. In this example, the first sampling station would be at 5 feet from the river bank's edge. The subsequent 15 verticals are then spaced 10 feet apart, resulting in sampling stations at 15, 25, 35, 45, ... and 155 feet. For fairly even flowing and level bottomed streams, only 10 verticals may be needed.

3.1.4 If the stream is < 5 feet wide, divide into as many equal increments as possible, with the minimum increment width being 3 inches.

3.2 Transit Rate

3.2.1 Using the data collected when gauging discharge, identify the fastest flowing increment in feet per second (fps) in the stream cross section. This velocity rating will determine which sampling device to use. Generally, the bronze D-77 operates at velocities up to 7.2 feet per second, and the aluminum D-77 to 3.3 feet per second. A wading rod should be used at slower moving, shallow sampling sites, where wading is safe.

3.2.2 Begin at the vertical determined from step 3.2.1 and lower the sampling unit (D-77 or wading rod) until the 3-liter Teflon® bottle's nozzle is just above the surface of the stream.

3.2.3 Using a stopwatch, determine the amount of time (in seconds) and number of transits (up and down movements of sampling unit through the water column at a slow, steady rate) that it takes to fill the sampling bottle without overfilling. (A bottle is overfilled when the water surface in the bottle is above the nozzle or air exhaust with the sampler held level.) The bottle does not fill on downward movements, only when it is being raised. However, it is important to maintain a steady rate in both directions in order to remain consistent and to minimize stream disturbance. Several iterations will be required to determine the final transit rate based on the amount of water to be collected. **This transit rate must be used at each vertical (sampling station)**. It is possible to sample at two or more verticals using the same bottle if the bottle is not overfilled.

3.3 Sample Collection

3.3.1 Begin sampling at first vertical station determined in step 3.1.3 and lower the sampling unit until the bottle's nozzle is just above the water surface.

3.3.2 Using the transit rate determined in step 3.2.3, lower unit into stream and raise to just below the surface once bottom is felt. The movement of the sampling unit throughout the water column must be constant and with minimal disturbance of the stream bottom. Continue across stream, collecting water at each vertical (sampling station), depositing collected water into a composite sample container. Complete the necessary number of transects, until desired volume is obtained. **Note: An equal number of transits must be made at each vertical.**

4.0 STUDY-SPECIFIC DECISIONS

Study specific information should be included in the study protocol, a separate document describing a specific study.

5.0 REFERENCES

Edwards, T.K. and D.G. Glysson. 1988. Field Methods for Measurement of Fluvial Sediment, U.S. Geological Survey Open-File Report 86-531. pp. 61-64.